PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-038791

(43)Date of publication of application : 13.02.2001

(51)Int.Cl. B29C 47/66
B23K 20/00
C23C 4/08

(21)Application number : 11-213733

(22)Date of filing : 28.07.1999

(71)Applicant : TOSHIBA MACH CO LTD

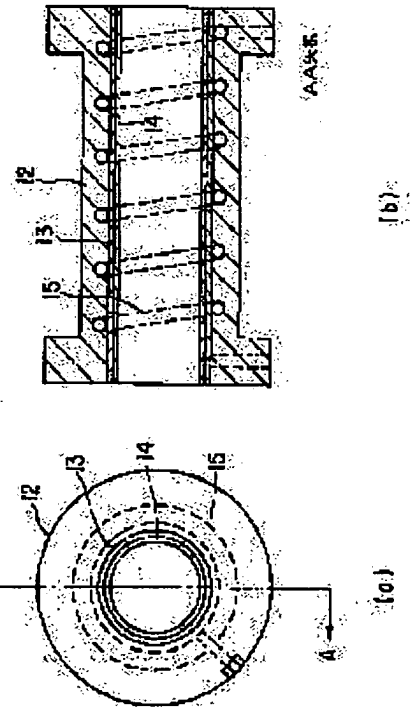
(72)Inventor : TAKAHASHI SAKAE
MOCHIZUKI ZENICHI

(54) PRODUCTION OF HOLLOW MEMBER HAVING CORROSION RESISTANCE AND ABRASION RESISTANCE

(57)Abstract:

PROBLEM TO BE SOLVED: To more inexpensively produce a hollow member having sufficient corrosion resistance and abrasion resistance against molten plastic.

SOLUTION: The single-screw barrel of an extrusion molding machine is equipped with a cylindrical main body part 12, the decarburization layer 13 formed on the inner peripheral surface thereof and the surface coating layer 14 bonded to the decarburization layer. The main body part 12 is made of spheroidal graphite cast iron (e.g. FCD 600) and a cooling pipe 15 is spirally cast along the inner peripheral surface of the main body part. The decarburization layer 13 is formed by immersing the main body part in a salt bath of NaOH (or subjecting the same to decarburization treatment in a decarburizing atmosphere furnace). The surface coating layer 14 is formed by the plasma spraying of an Ni-base self-fluxing alloy (or a Co-base self-fluxing alloy).



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

DERWENT-ACC-NO: 2001-239349

DERWENT-WEEK: 200147

TITLE: Manufacture of hollow material such as barrel for extruders, involves forming coating layer of nickel or copper group alloy on de carburized layer which is formed around through-hole of hollow material

PATENT-ASSIGNEE: TOSHIBA MACHINE CO LTD[TOSI]

PRIORITY-DATA: 1999JP-0213733 (July 28, 1999)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 2001038791 A	February 13, 2001	N/A	005	B29C 047/66

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP2001038791A	N/A	1999JP-0213733	July 28, 1999

INT-CL (IPC): B23K020/00, B29C047/66 , C23C004/08

ABSTRACTED-PUB-NO: JP2001038791A

BASIC-ABSTRACT:

NOVELTY - A hollow material of cast iron is provided. A de carburized layer (13) is formed around the through-hole of the hollow material, on which a coating layer (15) containing self-fluxing alloy of nickel or cobalt is formed by thermal spraying, overlay welding or HIP shaping.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for barrel for extrusion machines.

USE - For manufacture of hollow material such as barrel for extruders.

ADVANTAGE - The hollow material is inexpensive, has excellent corrosion resistance, wear resistance, and is manufactured easily at low cost.

DESCRIPTION OF DRAWING(S) - The figure shows top elevation view and axial sectional view of hollow material.

De carburized layer 13

Coating layer 15

CHOSEN-DRAWING: Dwg.1/2

TITLE-TERMS: MANUFACTURE HOLLOW MATERIAL BARREL EXTRUDE FORMING COATING LAYER NICKEL COPPER GROUP ALLOY DE LAYER FORMING THROUGH HOLE HOLLOW MATERIAL

DERWENT-CLASS: A32 M13 M23 P55

CPI-CODES: A11-B07; M13-C; M23-D01A2;

ENHANCED-POLYMER-INDEXING:
Polymer Ind x [1.1]
018 ; P0000
Polymer Index [1.2]
018 ; ND05 ; J9999 J2915*R ; J9999 J2904 ; K9416 ; N9999 N5970*R

SECONDARY-ACC-NO:
CPI Secondary Accession Numbers: C2001-072169
Non-CPI Secondary Accession Numbers: N2001-171378

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the centrum material equipped with the corrosion resistance and abrasion resistance which are characterized by having the process which covers the self-fluxing alloy of nickel system or Co system with the approach of thermal spraying, welding padding or HIP shaping either on this decarburized layer the process which prepares the centrum material made of cast iron which has a through tube in the center, and the degree which performs decarbonization processing to the surface section of said through tube, and forms a decarburized layer.
[Claim 2] So that decarbonization processing is performed to the process which prepares the centrum material made of cast iron which has a through tube in the center, and the surface section of said through tube and a decarburized layer is formed The manufacture approach of the centrum material equipped with the corrosion resistance and abrasion resistance which are characterized by having the process which covers with the approach of thermal spraying, welding padding or HIP shaping either the alloy which made either of the self-fluxing alloys of nickel system or Co system distribute the ceramics on this decarburized layer.
[Claim 3] Centrum material equipped with the corrosion resistance and abrasion resistance which are characterized by having the body made of cast iron which has a through tube in the center, the decarburized layer prepared at the surface section of said through tube, and the surface coating layer which is joined on this decarburized layer and consists of a self-fluxing alloy of nickel system or Co system.
[Claim 4] Centrum material equipped with the corrosion resistance and abrasion resistance which are characterized by having the body made of cast iron which has a through tube in the center, the decarburized layer prepared at the surface section of said through tube, and the surface coating layer which consists of an alloy which it is joined [alloy] on this decarburized layer and made either of the self-fluxing alloys of nickel system or Co system distribute the ceramics.
[Claim 5] Barrel for extruding press machines characterized by having the body made of cast iron which has a through tube in the center, the decarburized layer prepared at the surface section of said through tube, and the surface coating layer which is joined on this decarburized layer and consists of a self-fluxing alloy of nickel system or Co system.
[Claim 6] Barrel for extruding press machines characterized by having the body made of cast iron which has a through tube in the center, the decarburized layer prepared at the surface section of said through tube, and the surface coating layer which consists of an alloy which it is joined [alloy] on this decarburized layer and made either of the self-fluxing alloys of nickel system or Co system distribute the ceramics.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the centrum material equipped with corrosion resistance and abrasion resistance, and its manufacture approach, and in case it manufactures the barrel for extruding press machines especially, it relates to the suitable manufacture approach.
[0002]
[Description of the Prior Art] extruding press machines, such as the former and plastic material, -- cast iron or carbon steel is used for the barrel in which it is and a material just before being fabricated is held.

[0003] Since the barrel made of high intensity cast iron (for example, FCD450) can be equipped with the mechanical strength demanded and can make the configuration by casting, it can be comparatively manufactured by low cost. However, since abrasion resistance is required, surface hardening, such as induction hardening or nitriding, is performed to the part of the sliding surface in contact with a screw etc. However, corrosion resistance is not improved in these processings.
[0004] therefore, abrasion resistance -- in addition, when the corrosion resistance over melting plastics etc. is required, the body part (base material part) of a barrel is manufactured with carbon steel, and what used the self-fluxing alloy of nickel system or Co system for the front face, and performed welding padding is used. Thus, since it must begin to delete a central through tube by machining especially when manufacturing a body part with carbon steel, increase of a manufacturing cost is caused.
[0005] For this reason, to manufacture a body part with high intensity cast iron, to use the above ingredients for the part to which corrosion resistance is demanded in addition to abrasion resistance, and to perform thermal spraying or welding padding was desired. However, if the self-fluxing alloy of nickel system or Co system is used for the front face of cast iron material and thermal spraying is performed, when the carbon and silicon in cast iron are spread in an enveloping layer (thermal-spraying layer), a crack will occur in an enveloping layer. For example, if the carbon concentration in an enveloping layer becomes 0.4% or more, a crack will become easy to go into an enveloping layer with the diffused carbon. For this reason, by the time such an approach is still put in practical use, it will not have resulted.
[0006] In addition, the approach of manufacturing the heating cylinder of 3 layer structure is indicated by JP,2-34270,B by arranging a curtain board in mold, pouring the metal molten metal used as a heating cylinder body into the outside, and pouring the molten metal of an anticorrosion abrasion resistance metal into the inside. However, there is a problem referred to as being restricted to an iron system ingredient in this approach.
[0007]
[Problem(s) to be Solved by the Invention] Accomplishing this invention in view of the trouble of the manufacture approach of the above barrels for the conventional extruding press machines, the purpose of this invention is to offer the manufacture approach of the centrum material which can be equipped with sufficient corrosion resistance and abrasion resistance, and can be manufactured at low cost

compared with the conventional approach to melting plastics etc.
[0008]
[Means for Solving the Problem] The manufacture approach of the centrum material equipped with the corrosion resistance and abrasion resistance of this invention is characterized by having the process which covers the self-fluxing alloy of nickel system or Co system with the approach of thermal spraying, welding padding or HIP shaping either on this decarburized layer the process which prepares the centrum material made of cast iron which has a through tube in the center, and the degree which performs decarbonization processing to the surface section of said through tube, and forms a decarburized layer.
[0009] Since according to the manufacture approach of the compound member of this invention a decarburized layer is formed in the front face of the base material made of cast iron and thermal spraying (or welding padding, HIP shaping) of the self-fluxing alloy of nickel system or Co system is carried out on the decarburized layer, the phenomenon which carbon and silicon diffuse can be prevented from the cast iron of a base material in the surface coating layer which consists of a self-fluxing alloy of nickel system or Co system.
[0010] The centrum material equipped with corrosion resistance and abrasion resistance on the base material made of cast iron by this by becoming possible to join the surface coating layer which has corrosion resistance and abrasion resistance, for example, the barrel for extruding press machines, and the cylinder for injection molding machines can be manufactured at comparatively low cost.
[0011] In addition, thickness of said decarburized layer is preferably set to 0.5mm or more and 1.5mm or less.
[0012] Moreover, in the above-mentioned manufacture approach, the alloy which made either of the self-fluxing alloys of nickel system or Co system distribute the ceramics can also be used instead of the self-fluxing alloy of nickel system or Co system. If it is made this appearance, the abrasion resistance of the surface coating layer concerned can be raised further.
[0013]
[Embodiment of the Invention] Next, based on this invention, an example of the approach of manufacturing the centrum material which has a through tube in the center is explained.
[0014] First, the body part (base material) of the centrum material concerned is cast using high intensity cast iron (with an or more [400Ns //mm] 2 tensile strength spheroidal graphite cast iron). A predetermined dimension is made to the inner skin of a cast by machining. Next, that organization is changed into a ferrite by performing removal and decarbonization of a graphite in the surface section of the inner skin of this cast. Here, there is the following approach as an approach of performing removal and decarbonization of a graphite in the surface section of cast iron.
[0015] (b) Insert in a cast in a heating furnace and adjust the concentration of the oxygen in a heating furnace to about 5 - 10% (nitrogen is mixed in air). A cast is immersed into the salt bath (250-500 degrees C) of melting caustic alkali of sodium. approach (**) decarbonized by oxidizing the carbon of the surface section of a cast alternatively -- The approach decarbonized by making it oxidize by passing a direct current (C+NaOH->NaCO3) (called the "Colleen process")
By one of the above-mentioned approaches, the organization of the surface section of the base material made of cast iron is changed into a ferrite. In addition, about 0.5-1.5mm is suitable for the thickness of a decarburized layer.
[0016] Subsequently, after performing shot blasting to the front face and attaching irregularity to it, a cast is beforehand heated at about 100-200 degrees C. In addition, a preheating is given for preventing that a crack arises into a base material part in the case of the thermal-spraying process which follows. In addition, when the thickness of a cast is 50mm or less, if it becomes hot beforehand near 200 degree C when thickness is 50mm or more, it will be hard to generate a crack into a base material part near 100 degree C.
[0017] Subsequently, on it, thermal spraying of the self-fluxing alloy of Co system or nickel system is carried out, and a surface coating layer is formed. This gives corrosion resistance and abrasion resistance to the front face of the base material made of cast iron.

[0018] In addition, the alloy which made either of the self-fluxing alloys of nickel system or Co system distribute the ceramics can also be used instead of the self-fluxing alloy of nickel system or Co system. Moreover, a surface coating layer can also be formed with the welding padding or HIP shaping other than thermal spraying.
[0019] Next, the durable test result of the monopodium barrel of the extruding press machine for plastics manufactured based on the approach of this invention is explained.
[0020] (Example 1) The monopodium barrel equipped with the configuration shown in drawing 1 for extruding press machines was manufactured. As for the body part (base material) of the product [12] made of cast iron, and 13, a decarburized layer and 14 are surface coating layers among drawing.
[0021] The body part 12 was manufactured by casting using spheroidal graphite cast iron FCD600. In addition, the body part 12 is met at the inner skin, and a cooling pipe 15 is ****** rare ****** spirally. After finishing the inner skin of the body part 12 by cutting, this was immersed into the salt bath which uses melting caustic alkali of sodium as a principal component, and removal and decarbonization of the graphite of the surface section were performed at the temperature of 450 degrees C, having applied the direct current voltage of 3-5V.
[0022] Next, after performing shot blasting to the front face of the decarburized layer formed by carrying out in this way, the preheating was carried out to 150 degrees C, and nickel system self-fluxing alloy (JIS MSF nickel 3) was covered with thermal spraying. In addition, thickness of the surface coating layer 14 was set to about 2.5mm. Finally, the inner skin of the surface coating layer 14 was finished by machining.
[0023] Generating of a crack was not accepted although the inner skin was investigated by Penetrant Test about the monopodium barrel manufactured as mentioned above.
[0024] Next, this monopodium barrel was included in the extruding press machine for ABS plastics, and the continuous running test was performed on condition that the molding temperature of 250 degrees C, and rotational frequency 300rpm. Consequently, generating of a crack or exfoliation of a surface coating layer was not accepted after use of 10000 hours. It was checked by this that the monopodium cylinder based on the manufacture approach of this invention is equipped with sufficient corrosion resistance and abrasion resistance.
[0025] (Example 2) The 2 shaft cylinder equipped with the configuration shown in drawing 2 for extruding press machines was manufactured. As for the body part of the product [22] made of cast iron, and 23, a decarburized layer and 24 are surface coating layers among drawing.
[0026] The body part 22 was manufactured by casting using spheroidal graphite cast iron FCD600. In addition, it is ****** rare ****** to the shape of a spiral which the cooling pipe 25 deformed into the body part 22 along with the inner skin. After finishing the inner skin of the body part 22 by cutting, the oxygen density inserted in the body part 22 in the decarbonization ambient atmosphere furnace adjusted to 8%, performed heating at 850 degrees C for 5 hours, and performed the removal and decarbonization of a graphite in the surface section of a cast iron base material.
[0027] Next, after performing shot blasting to the front face of the decarburized layer formed by carrying out in this way, the preheating was carried out to 200 degrees C, and nickel system self-fluxing alloy containing WC powder (JIS MSF WC 2) was covered with thermal spraying. In addition, thickness of the surface coating layer 14 was set to about 2.5mm. Finally, the inner skin of the surface coating layer 24 was finished by machining.
[0028] Generating of a crack was not accepted although the inner skin was investigated by Penetrant Test about 2 shaft barrels manufactured as mentioned above.
[0029] Next, this 2 shaft barrel was included in the extruding press machine for the ABS plastics containing 30% of glass fibers, and the continuous running test was performed on condition that the molding temperature of 250 degrees C, and rotational frequency 600rpm. Consequently, generating of a crack or exfoliation of a surface coating layer was not accepted after use of 5000 hours. It was checked by this that 2 shaft barrels based on the manufacture approach of this invention are equipped with sufficient corrosion resistance and abrasion resistance.
[0030]

[Effect of the Invention] According to this invention, it becomes possible to prepare the surface coating layer which has corrosion resistance and abrasion resistance on the base material made of cast iron, and the centrum material equipped with corrosion resistance and abrasion resistance, for example, the barrel for extruding press machines, can be manufactured at comparatively low cost.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2001－38791
（P2001－38791A）
(43)公開日　平成13年２月13日(2001.2.13)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'(参考)
Ｂ２９Ｃ　47/66		Ｂ２９Ｃ　47/66		４Ｅ０６７
Ｂ２３Ｋ　20/00		Ｂ２３Ｋ　20/00	Ｂ	４Ｆ２０７
Ｃ２３Ｃ　4/08		Ｃ２３Ｃ　4/08		４Ｋ０３１

審査請求　未請求　請求項の数６　ＯＬ　（全５頁）

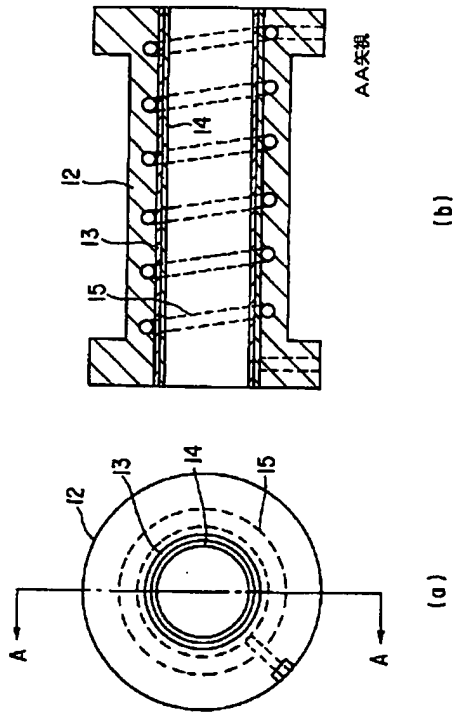
(21)出願番号　特願平11－213733
(22)出願日　平成11年７月28日(1999.7.28)

(71)出願人　000003458
東芝機械株式会社
東京都中央区銀座４丁目２番11号
(72)発明者　高橋　栄
静岡県沼津市大岡2068の３　東芝機械株式会社沼津事業所内
(72)発明者　望月　善一
静岡県沼津市大岡2068の３　東芝機械テクノ株式会社内
(74)代理人　100058479
弁理士　鈴江　武彦　（外６名）

最終頁に続く

(54)【発明の名称】　耐食性及び耐摩耗性を備えた中空部材の製造方法

(57)【要約】
【課題】　溶融プラスチックなどに対して十分な耐食性及び耐摩耗性を備え、且つ、従来と比べて低コストで製造することができる中空部材の製造方法を提供する。
【解決手段】　本発明に基づく押出成形機用の単軸バレルは、円筒状の本体部分１２、その内周面の表層部に形成された脱炭層１３、この脱炭層の上を接合された表面被覆層１４を備える。本体部分１２は球状黒鉛鋳鉄製（例えば、ＦＣＤ６００）であり、その内周面に沿って冷却パイプ１５が螺旋状に鋳ぐるまれている。脱炭層１３は、ＮａＯＨの塩浴中への浸漬（あるいは脱炭雰囲気炉中での脱炭処理）によって形成される。表面被覆層１４は、Ｎｉ系自溶合金（または、Ｃｏ系自溶合金）の溶射等によって形成される。



1

【特許請求の範囲】
【請求項1】　中央に貫通孔を有する鋳鉄製の中空部材を準備する工程と、
前記貫通孔の表層部に脱炭処理を施して脱炭層を形成する程と、
この脱炭層の上に、Ｎｉ系またはＣｏ系の自溶合金を溶射、溶接肉盛りまたはＨＩＰ成形のいずれかの方法により被覆する工程と、
を備えたことを特徴とする耐食性及び耐摩耗性を備えた中空部材の製造方法。
【請求項2】　中央に貫通孔を有する鋳鉄製の中空部材を準備する工程と、
前記貫通孔の表層部に脱炭処理を施して脱炭層を形成する程と、
この脱炭層の上に、Ｎｉ系またはＣｏ系の自溶合金のいずれかにセラミックスを分散させた合金を溶射、溶接肉盛りまたはＨＩＰ成形のいずれかの方法により被覆する工程と、
を備えたことを特徴とする耐食性及び耐摩耗性を備えた中空部材の製造方法。
【請求項3】　中央に貫通孔を有する鋳鉄製の本体と、
前記貫通孔の表層部に設けられた脱炭層と、
この脱炭層の上に接合され、Ｎｉ系またはＣｏ系の自溶合金からなる表面被覆層と、
を備えたことを特徴とする耐食性及び耐摩耗性を備えた中空部材。
【請求項4】　中央に貫通孔を有する鋳鉄製の本体と、
前記貫通孔の表層部に設けられた脱炭層と、
この脱炭層の上に接合され、Ｎｉ系またはＣｏ系の自溶合金のいずれかにセラミックスを分散させた合金からなる表面被覆層と、
を備えたことを特徴とする耐食性及び耐摩耗性を備えた中空部材。
【請求項5】　中央に貫通孔を有する鋳鉄製の本体と、
前記貫通孔の表層部に設けられた脱炭層と、
この脱炭層の上に接合され、Ｎｉ系またはＣｏ系の自溶合金からなる表面被覆層と、
を備えたことを特徴とする押出成形機用のバレル。
【請求項6】　中央に貫通孔を有する鋳鉄製の本体と、
前記貫通孔の表層部に設けられた脱炭層と、
この脱炭層の上に接合され、Ｎｉ系またはＣｏ系の自溶合金のいずれかにセラミックスを分散させた合金からなる表面被覆層と、
を備えたことを特徴とする押出成形機用のバレル。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、耐食性及び耐摩耗性を備えた中空部材及びその製造方法に係り、特に、押出成形機用のバレルを製作する際に好適な製造方法に関する。

2

【０００２】
【従来の技術】従来、プラスチック材料などの押出成形機おいて、成形される直前の素材が収容されるバレルには、鋳鉄あるいは炭素鋼が使用されている。
【０００３】高強度鋳鉄（例えば、ＦＣＤ４５０）製のバレルは、要求される機械的強度を備え、且つ鋳造によりその形状を作り出すことができるので、比較的、低コストで製作することができる。但し、スクリュなどと接触する摺動面の部分には、耐摩耗性が要求されるので、高周波焼入れあるいは窒化などの表面硬化処理が施される。しかし、これらの処理では、耐食性までは改善されない。
【０００４】従って、耐摩耗性に加えて、溶融プラスチックなどに対する耐食性が要求される場合には、バレルの本体部分（母材部分）を炭素鋼で製作し、その表面に、Ｎｉ系あるいはＣｏ系の自溶合金を用いて溶接肉盛りを施したものが使用されている。この様に、本体部分を炭素鋼で製作する場合には、特に中央の貫通孔を機械加工によって削り出さなければならないので、製造コストの増大を招く。
【０００５】このため、本体部分を高強度鋳鉄で製作し、耐摩耗性に加えて耐食性が要求される部位に、上記の様な材料を用いて溶射あるいは溶接肉盛り等を施すことが望まれていた。しかし、鋳鉄材の表面にＮｉ系あるいはＣｏ系の自溶合金を用いて溶射を施すと、被覆層（溶射層）の中に鋳鉄中の炭素及びシリコンが拡散することによって、被覆層にクラックが発生する。例えば、拡散した炭素によって、被覆層中の炭素濃度が０．４％以上になると、被覆層にクラックが入り易くなる。このため、この様な方法は、未だ実用化されるまでには至っていない。
【０００６】なお、特公平２－３４２７０号公報には、鋳型内に隔壁板を配置し、その外側に加熱シリンダ本体となる金属溶湯を注入し、その内側に耐食耐摩耗性金属の溶湯を注入することによって、三層構造の加熱シリンダを製作する方法が記載されている。しかし、この方法には、鉄系材料に限られると言う問題がある。
【０００７】
【発明が解決しようとする課題】本発明は、以上の様な従来の押出成形機用のバレルの製造方法の問題点に鑑み成されたもので、本発明の目的は、溶融プラスチックなどに対して十分な耐食性及び耐摩耗性を備え、且つ、従来の方法と比べて低いコストで製造することができる中空部材の製造方法を提供することにある。
【０００８】
【課題を解決するための手段】本発明の耐食性及び耐摩耗性を備えた中空部材の製造方法は、中央に貫通孔を有する鋳鉄製の中空部材を準備する工程と、前記貫通孔の表層部に脱炭処理を施して脱炭層を形成する程と、この脱炭層の上に、Ｎｉ系またはＣｏ系の自溶合金を溶射、

溶接肉盛りまたはＨＩＰ成形のいずれかの方法により被覆する工程と、を備えたことを特徴とする。

【０００９】本発明の複合部材の製造方法によれば、鋳鉄製の母材の表面に脱炭層を形成し、その脱炭層の上に、Ｎｉ系またはＣｏ系の自溶合金を溶射（または、溶接肉盛り、ＨＩＰ成形）しているので、Ｎｉ系またはＣｏ系の自溶合金からなる表面被覆層の中に、母材の鋳鉄から炭素及びシリコンが拡散する現象を防止することができる。

【００１０】これによって、鋳鉄製の母材の上に、耐食性及び耐摩耗性を兼ね備えた表面被覆層を接合することが可能になり、耐食性及び耐摩耗性を備えた中空部材、例えば、押出成形機用のバレルあるいは射出成形機用のシリンダを、比較的低いコストで製作することができる。

【００１１】なお、好ましくは、前記脱炭層の厚さを、０．５ｍｍ以上、１．５ｍｍ以下とする。

【００１２】また、上記の製造方法において、Ｎｉ系またはＣｏ系の自溶合金の代わりに、Ｎｉ系またはＣｏ系の自溶合金のいずれかにセラミックスを分散させた合金を使用することもできる。この様にすれば、当該表面被覆層の耐摩耗性を更に向上させることができる。

【００１３】

【発明の実施の形態】次に、本発明に基づいて、中央に貫通孔を有する中空部材を製作する方法の一例について説明する。

【００１４】先ず、高強度鋳鉄（引張強さ４００Ｎ／ｍｍ^{2}以上の球状黒鉛鋳鉄）を用いて、当該中空部材の本体部分（母材）を鋳造する。鋳造品の内周面を、機械加工によって所定の寸法に仕上げる。次に、この鋳造品の内周面の表層部において黒鉛の除去及び脱炭を行うことによって、その組織をフェライトに変える。ここで、鋳鉄の表層部において黒鉛の除去及び脱炭を行う方法としては、下記の方法がある。

【００１５】（イ）加熱炉の中に鋳造品を装入し、加熱炉内の酸素の濃度を５～１０％程度に調整し（空気に窒素を混入する）、鋳造品の表層部の炭素を選択的に酸化することによって脱炭を行う方法

（ロ）溶融苛性ソーダの塩浴（２５０～５００℃）の中に鋳造品を浸漬し、直流電流を流して酸化反応（Ｃ＋ＮａＯＨ→ＮａＣＯ$_3$）を行わせ、脱炭を行う方法（「コリーンプロセス」と呼ばれる）

上記のいずれかの方法によって、鋳鉄製の母材の表層部の組織をフェライトに変える。なお、脱炭層の厚さは、０．５～１．５ｍｍ程度が適当である。

【００１６】次いで、その表面にショットブラストを施して凹凸を付けた後、鋳造品を、１００～２００℃程度に予熱する。なお、予熱を施すのは、後続する溶射工程の際、母材部分にクラックが生ずるのを防止するためである。なお、鋳造品の肉厚が５０ｍｍ以下の場合には１００℃付近に、肉厚が５０ｍｍ以上の場合には２００℃付近に予熱すると、母材部分にクラックが発生しにくい。

【００１７】次いで、その上にＣｏ系またはＮｉ系の自溶合金を溶射して表面被覆層を形成する。これによって、鋳鉄製の母材の表面に耐食性及び耐摩耗性を付与する。

【００１８】なお、Ｎｉ系またはＣｏ系の自溶合金の代わりに、Ｎｉ系またはＣｏ系の自溶合金のいずれかにセラミックスを分散させた合金を使用することもできる。また、溶射の他に、溶接肉盛りあるいはＨＩＰ成形により表面被覆層を形成することもできる。

【００１９】次に、本発明の方法に基づいて製作されたプラスチック用の押出成形機の単軸バレルの耐用試験結果について説明する。

【００２０】（例１）図１に示す形状を備えた押出成形機用の単軸バレルを製作した。図中、１２は鋳鉄製の本体部分（母材）、１３は脱炭層、１４は表面被覆層である。

【００２１】本体部分１２を、球状黒鉛鋳鉄ＦＣＤ６００を用いて鋳造によって製作した。なお、本体部分１２には、その内周面に沿って冷却パイプ１５が螺旋状に鋳ぐるまれている。本体部分１２の内周面を切削によって仕上げた後、これを、溶融苛性ソーダを主成分とする塩浴中に浸漬し、温度４５０℃で、３～５Ｖの直流電圧をかけて、表層部の黒鉛の除去及び脱炭を行った。

【００２２】次に、この様にして形成された脱炭層の表面にショットブラストを施した後、１５０℃に予熱し、Ｎｉ系自溶合金（ＪＩＳ　ＭＳＦ　Ｎｉ　３）を溶射により被覆した。なお、表面被覆層１４の厚さは約２．５ｍｍとした。最後に、表面被覆層１４の内周面を、機械加工によって仕上げた。

【００２３】上記の様にして製作された単軸バレルについて、その内周面を浸透探傷試験によって調べたが、クラックの発生は認められなかった。

【００２４】次に、この単軸バレルを、ＡＢＳ樹脂用の押出成形機に組み込み、成形温度２５０℃、回転数３００ｒｐｍの条件で連続運転試験を行った。その結果、１００００時間の使用の後においても、クラックの発生あるいは表面被覆層の剥離は認められなかった。これによって、本発明の製造方法に基づく単軸シリンダは、十分な耐食性及び耐摩耗性を備えていることが確認された。

【００２５】（例２）図２に示す形状を備えた押出成形機用の二軸シリンダを製作した。図中、２２は鋳鉄製の本体部分、２３は脱炭層、２４は表面被覆層である。

【００２６】本体部分２２を、球状黒鉛鋳鉄ＦＣＤ６００を用いて鋳造によって製作した。なお、本体部分２２には、その内周面に沿って冷却パイプ２５が変形した螺旋状に鋳ぐるまれている。本体部分２２の内周面を切削によって仕上げた後、酸素濃度が８％に調整された脱炭

雰囲気炉の中に本体部分２２を装入し、８５０℃で５時間加熱を行い、鋳鉄母材の表層部における黒鉛の除去及び脱炭を行った。

【００２７】次に、この様にして形成された脱炭層の表面にショットブラストを施した後、２００℃に予熱し、ＷＣ粉末入りのＮｉ系自溶合金（ＪＩＳ　ＭＳＦ　ＷＣ２）を溶射により被覆した。なお、表面被覆層１４の厚さは約２．５ｍｍとした。最後に、表面被覆層２４の内周面を、機械加工によって仕上げた。

【００２８】上記の様にして製作された二軸バレルについて、その内周面を浸透探傷試験によって調べたが、クラックの発生は認められなかった。

【００２９】次に、この二軸バレルを、ガラス繊維３０％入りのＡＢＳ樹脂用の押出成形機に組み込み、成形温度２５０℃、回転数６００ｒｐｍの条件で連続運転試験を行った。その結果、５０００時間の使用の後においても、クラックの発生あるいは表面被覆層の剥離は認められなかった。これによって、本発明の製造方法に基づく二軸バレルは、十分な耐食性及び耐摩耗性を備えていることが確認された。

【００３０】

【発明の効果】本発明によれば、鋳鉄製の母材の上に、耐食性及び耐摩耗性を兼ね備えた表面被覆層を設けることが可能になり、耐食性及び耐摩耗性を備えた中空部材、例えば、押出成形機用のバレルを、比較的低いコストで製作することができる。

【図面の簡単な説明】

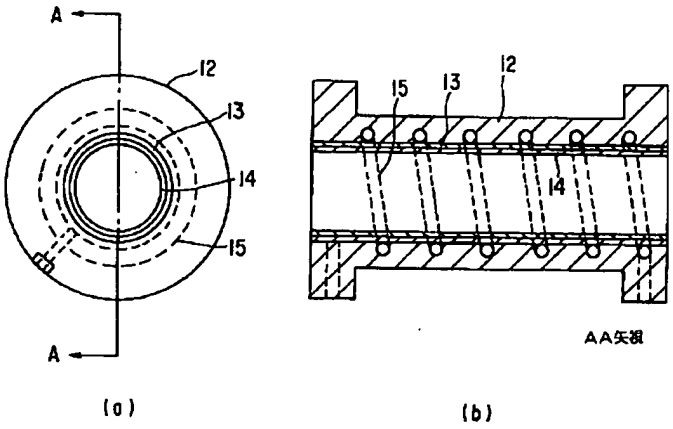
【図１】本発明の方法に基づいて製作された押出成形機用の単軸バレルの構造を示す図、（ａ）は上面図、（ｂ）軸方向断面図である。

【図２】本発明の方法に基づいて製作された押出成形機用の二軸バレルの構造を示す図、（ａ）は上面図、（ｂ）軸方向断面図である。

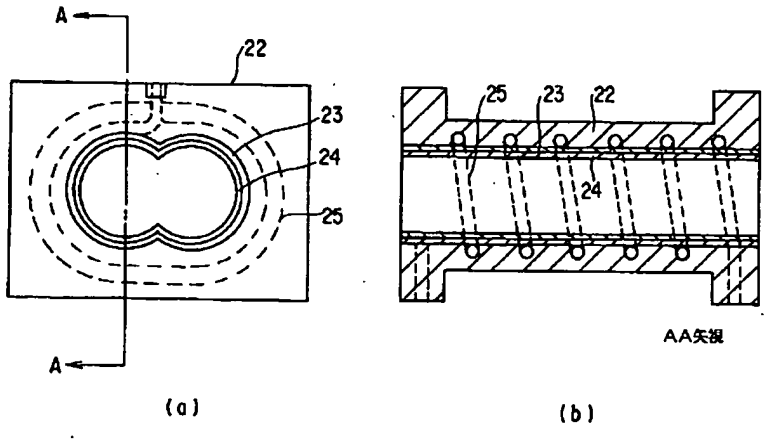
【符号の説明】

１２・・・本体部分（母材）、１３・・・脱炭層、１４・・・表面被覆層、１５・・・冷却パイプ、２２・・・本体部分（母材）、２３・・・脱炭層、２４・・・表面被覆層、２５・・・冷却パイプ。

【図１】



【図２】



フロントページの続き

Fターム(参考) 4E067 AA04 AB01 AB05 AB10 AD08
AD12 BA06 EB00 EC06
4F207 AJ02 AJ06 AJ09 AJ14 AJ15
KA01 KK43 KL32
4K031 AA01 AA03 AB08 AB09 BA08
CB30 CB41 EA05